DIFFUSION INDUCED PLASTICITY OF NANOSTRUCTURED METALS

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The main characteristic features of grain boundary diffusion of substitution impurities from an external source (coating) in nanostructured (produced by severe plastic deformation) metals (nickel, copper, titanium) have been considered in comparison with respective ones for grain boundaries in coarse-grained and nanocrystalline (using electrodeposited nickel by way of example) states. Physical reasons for the enhancement of diffusivity of grain boundaries in nanostructured state relative to the diffusivity coarse-grained metals and bicrystals are discussed.

The analysis of percularities and physical mechanisms of plastic deformation development during creep of nanostructured metals and dispersed hardened nanocomposites including under the action of directed grain-boundary diffusion fluxes of substitution or interstitial impurity from an external source (environment) has been carried on.

The determining role of diffusion-controlled processes on grain boundaries in grain boundary sliding development during creep and superplastic flow of nanostructured metals and alloys in the service temperature (using Ni, Cu, Ti, Al-Mg-Li, etc. Based alloys by way of example) is found.

The possibility to realize low-temperature and/or high strain rate superplasticity of nanosrtuctured metals and alloys has been studied. The characteristic features of superplasticity of nanostructured materials relative to respective ones of fine-grained are discussed.